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INDIAN SCHOOL SOHAR
SECOND TERM EXAM- 2014
PHYSICS – THEORY

CLASS: XII **MARKS:70**
DATE: 1 /12/2014 **TIME:3hrs**

General Instructions:

1. All questions are compulsory.

2. There are 26 questions in all .Questions 1 to 5 carry one mark each, questions 6 to 10 carry two marks each, questions 11 to 22 carry three marks each. Question 23 is a value based question carrying four marks and questions 24 to 26 carry five marks each.

3. There is no overall choice. However, internal choice has been provided in one question of two marks, one question of three marks and all three questions of five marks each.

4. You have to attempt only one of the given choices in such questions.

5. Use of calculator is not permitted.

6. You may use the following physical constants wherever necessary

$C = 3X\ 10^{8}\ m/s$ $h = 6.626\ X10^{-34}\ Js$ $e = 1.6X\ 10^{-19}\ c$

$\frac{1}{4\pi\varepsilon O} = 9\ X\ 10^{9}\ Nm^2/c^2$. $\mu o = 4\pi\ X\ 10^{-7}\ T\ m\ A^{-1}$. $N_A = 6.023\ X10^{23}/mol$

$Mass\ of\ proton = 1.676\ X\ 10^{-27}\ kg.$ $Mass\ of\ neutron = 1.675\ X\ 10^{-27}\ kg.$

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1. A steady current flows in a metallic conductor of non-uniform cross section. Which of the quantities is constant along the conductor : - current, current density, drift speed, electric field. Justify. (1)

2. The refractive index of glass w.r.t air is 3/2 and the refractive index of water w.r.t air is 4/3. What is the refractive index of glass w.r.t. water? (1)

3. How long will a radioactive isotope, whose half-life is T years, take for its activity to reduce to 1/8 th of its initial value? (1)

4. In what medium should two charges be placed so that force between them may become $1/3^{rd}$ of that in vacuum? (1)

5. Show on a graph the variation of the de Broglie wave length associated with an electron with the accelerating potential. (1)

6. Two point charges 10μC and 40 μC are placed 6cm apart in vacuum. At what distance from 10μC charge, will the net electric field be zero?

OR

6. Two capacitors of capacitance 6μF and 12 μF are connected in series with a battery. The voltage across the 6μF capacitor is 2V. Compute the total battery voltage. (2)

7. Obtain, with the help of necessary diagram , the expression for the magnetic field in the

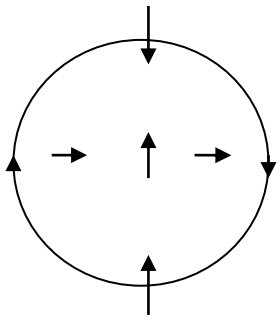
interior of a toroid carrying current. (2)

8. (a) A partially plane polarised beam of light is passed through a Polaroid. Show graphically the variation of the transmitted light intensity with angle of rotation of the polaroid.
(b) Explain with the help of a diagram how sunlight is polarized by scattering through atmospheric particles. (2)

9. (a) Draw the block diagram of a communication system.
(b) What is meant by 'detection' of a modulated carrier wave? Describe briefly the essential steps for detection. (2)

10. The value of ground state energy of hydrogen atom is -13.6 eV.
(a) What does the negative sign signify?
(b) How much energy is required to take an electron in this atom from the ground state to the first excited state? (2)

11. Figure shows a small magnetized needle 'P' placed at a point 'O'. The arrow shows the direction of its magnetic moment. The other arrows show different positions of another identical magnetized needle Q.
(a) In which configuration is the system in (i) stable, and (ii) unstable equilibrium?
(b) Which configuration corresponds to the lowest potential energy among all the configuration shown? (3)



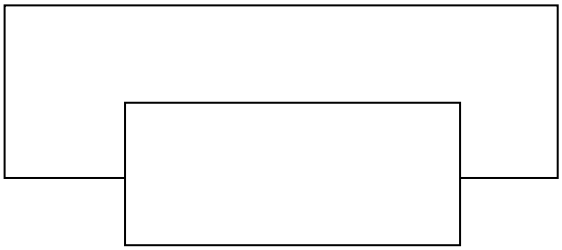
12. Draw the graphs showing the variation of photoelectric current with anode potential of a photocell for (a) the same frequencies but different intensities $I_1 > I_2 > I_3$ of the incident radiation,(b) the same intensity but different frequencies $v_1 > v_2 > v_3$ of the incident radiation. Explain why the saturation current is independent of the anode potential. (3)

13. (i) Draw and explain the impedance diagram .
(ii) A series LCR circuit is connected to an a.c. source whose frequency is less than the resonant frequency of the circuit. Which one will you increase to improve the power factor of the circuit, L or C? justify your answer. (3)

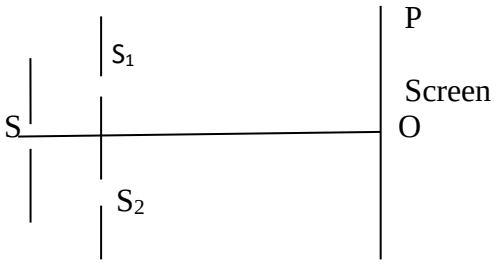
14. (a) Mention the advantages of a Cassegrain telescope
(b) A convex lens, of focal length 20cm, and a concave mirror, of focal length 10cm, are placed co-axially 50cm apart from each other. An incident beam parallel to its principal axis, is incident on the convex lens. Locate the position of the final image formed due to this combination. (3)

15. (a) Define the term resistivity of a conductor. Give its SI unit.

(b) Find the magnitude of the current supplied by the circuit shown in the figure. Also, find the potential difference between the points A and B. (3)

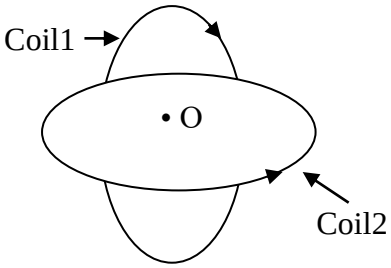


16. Obtain an expression for distance from the centre for bright and dark fringe in a Young's double slit experiment.
The figure given below shows an experimental set up for Young's double slit experiment to observe interference of light on the screen OP. Here the path difference SS_2-SS_1 = λ /4. Obtain the condition for (a) constructive ,and(b) destructive interference at any point P in terms of the path difference S_2P- S_1P (3)



17.(i) Define 'activity' of a radioactive material and write its S.I. units.(ii) Derive the equation for the law of radioactive decay(iii) The sequence of stepwise decay of a radioactive nucleus is $D \xrightarrow{\alpha} D_1 \xrightarrow{\beta^-} D_2$ If the atomic number and mass number of D_2 are 71 and 176 respectively, what are their corresponding values of D? (3)

18.(a)Derive an expression for magnetic field at a point P at a distance "x" from the centre of a current carrying coil.
(b)Two identical circular coils each of radius 10cm are arranged concentrically with their planes perpendicular to one another as in the figure. If current in each coil is 10A, what is net magnetic field at the common centre O? (3)

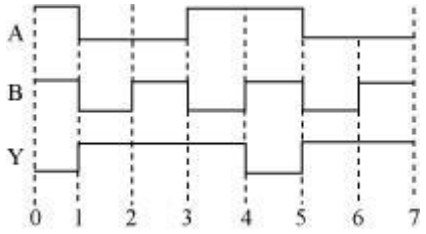


19.(a) State briefly any two reasons explaining the need for modulating a signal.
(b) Draw a labeled block diagram of simple modulator for obtaining an AM signal. (3)

OR

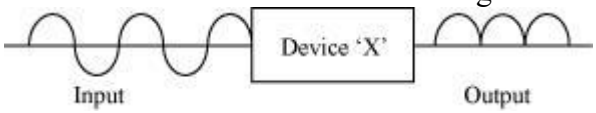
19. Explain the working of transistor amplifier as an oscillator.

The following figure shows the input waveforms (A, B) and the output waveform (Y) of a gate. Identify the gate, write its truth table and draw its logic symbol.



20. Electromagnetic radiations with certain wavelength (a) are used to kill germs in water purifier,(b) are used in TV communication system, (c) play an important role in maintaining the earth's warmth. Name the part of electromagnetic spectrum to which these radiations belong. Also write a short note on these radiations. (3)

21. (a) Explain the formation of depletion layer and potential barrier in a p–n junction.
(b) In the figure given below the input waveform is converted into the output waveform by a device 'X'. Name the device and draw its circuit diagram. (3)



22.(a) A small compass needle of magnetic moment 'M' and moment of inertia 'I' is free to oscillate in a magnetic field 'B'. It is slightly disturbed from its equilibrium position and then released. Show that it executes simple harmonic motion. Hence, write the expression for its time period.
(b) A magnetic needle, free to rotate in vertical plane, orients itself vertically at a certain place on the earth. What are the values of (i) horizontal component of the Earth's magnetic field and (ii) angle of dip at this place. (3)

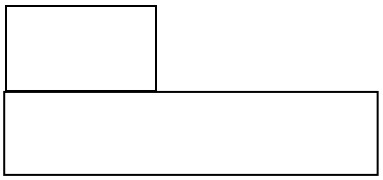
23. Narayan was doing social work during vacation. He visited a village where there was no electricity. He decided to help the villagers in purchasing solar panels. For this he made them aware about the technology and advantages. Villagers applied for solar panels and got it from government at nominal charges.
(a) What type of a person is Narayan?
(b) What is the principle of solar cell? How does it work? (4)

24.(a) You are given two convex lenses of short aperture having focal lengths 4cm and 8cm respectively. Which one of these will you use as an objective and which one as an eyepiece for constructing a compound microscope. Derive an expression for the magnifying power.
(b) A slit of width 'd'is illuminated by a light of wavelength 6000A. For what value of 'd' will the (i) first maximum fall at an angle of diffraction of 30^0 ?(ii) first minimum fall at an angle of diffraction of 30^0?

OR

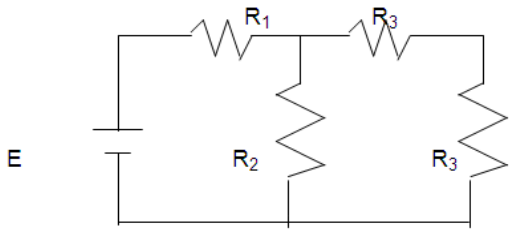
24. Derive lens maker's formula by considering concave lens.For a converging lens $r_1 = r_2$= 24cm and refractive index 1.6 (a) calculate its focal length in air and (b) if the lens is split vertically into two identical parts, what is the focal length of each part? (5)

25.(a) Derive an expression for the magnitude of electric field intensity at any point along the equatorial line of a short electric dipole. For a short dipole what is the ratio of electric field intensities at two equidistant points from the centre of the dipole? One along the axial line and another on the equatorial line.
(b)Find the charges on the capacitor as shown in the circuit.



OR

25.(a) Derive an expression for cells connected in parallels.
(b) Determine the voltage drop and hence power dissipated across the resistance R_2 in the circuit given with E = 65 V. R_1 = 50 ohms, R_2 = 100 ohms, R4=100 ohms, R_4 = 300 ohms.



26. A resistor 'R' and element 'X' are connected in series to an ac source of voltage. The voltage is found to lead the current in phase by π/4. If 'X' is replaced by another element 'Y', the voltage lags behind the current by π/4.
(a) Identify the elements. (b) when both the elements are connected in series with resistor to the same source, will the power dissipated in the circuit be maximum or minimum? Justify your answer.
(c) Show graphically the variation of inductive reactance and capacitive reactance with frequency of the applied alternating voltage.

OR

26. (a) Define the term 'mutual inductance'.
Deduce the expression for the mutual inductance of two long coaxial solenoids having different radii and different number of turns.
(b) A coil is mechanically rotated with constant angular speed ω in a uniform magnetic field which is perpendicular to the axis of rotation of the coil. The plane of the coil is initially held perpendicular to the field. Plot a graph showing variation of (i) magnetic flux ϕ and (ii) the induced emf in the coil as a function of ωt.